OBSERVATIONS ON THE POST-NATAL DEVELOPMENT OF INDIAN FALSE VAMPIRE BAT *MEGADERMA LYRA* (MICROCHIROPTERA)[1]

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(*With two text-figures*)

Key words: *Megaderma lyra*, bats, forearm length, weaning, fledgling stage.

Growth and development of the young *Megaderma lyra* were observed under natural conditions. Forearm length, length of third and fifth fingers were measured as indices of growth rate in *M. lyra*. By the age of 5 to 6 weeks young bats attained about 80% growth characteristics of the adults and were able to fly. Weaning occurred at the age of 2.5 months.

Introduction

In several species of bats, the growth of the body of the young is rapid during early life. The young animals weigh almost as much as the adults when they are about 5 months of age, so that young ones cannot be distinguished from the adults on the basis of the size of the body after this age (Madhavan 1978). The growth curves of certain species of bats such as *Rousettus aegyptiacus* show that individual variations are very slight in the first phase of development. This may be taken as a hint of a strict genetic determination of the neonatal period (Noll 1979). Many qualitative and analytical approaches have been used to describe post-natal growth in insectivorous bats. Some workers have used various kinds of allometric analyses to characterize post-natal growth (Yokoyama *et al.* 1975). Since in many cases growth of forearm length and the fingers can be measured easily and consistently, they have become the characters of choice in most studies on post-natal development (Kunz and Anthony 1982). In general, the length of forearm is stabilized at about 5-6 weeks of age and is close to the adult size (as in *Plecotus townsendii* - Pearson *et al.* 1952; *Nyctalus noctula*-Kleiman 1969; and *Myotis velifer* - Kunz 1973). The growth of the 3rd and 4th fingers occurs at a more rapid rate than that of the 2nd and 5th fingers (Funakoshi and Uchida 1981). In most species of bats, increase of body weight is very rapid during the first four weeks following birth. Birth weight of young is 20% to 25% of the mother's post-partum weight and double by the end of 2nd week (Orr 1970).

Although some aspects of reproduction and sexual cycles such as mating, gestation and embryology of the Indian false vampire bat *Megaderma lyra* (Gopalakrishna 1969) have been studied in detail, post-natal development in this species is poorly understood. We have gathered data relating to growth and development of the young in *M. lyra*. The information given here is based upon bats born in their natural habitat.

Material and Methods

The studies on *M. lyra* were conducted in a temple roost at Krishnapuram (8° 44' N lat, 77° 42' E long - Southern India). Data on growth of *M. lyra* were obtained from the maternity colony of approximately 70 adult females and

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their young located in the temple during the breeding months (March-June) in 1990. Juvenile bats were captured with a hand-held collecting net along with mothers from the day roost. Each individual was banded with a plastic collar having a coloured bead for individual identification (Balasingh *et al.* 1992). The sex of the young ones was noted, and the presence or absence of an umbilical cord or placenta was recorded. Right forearm length and the length of third and fifth fingers was measured with high precision Vernier calipers. To maximise sample size, juveniles were also collected from other roosts like cow-sheds and unused houses between 1930 hrs and 2100 hrs following the departure of mothers for foraging. After taking measurements of the forearm length and the length of third and fifth fingers, the juveniles were placed back in their respective roosting places, usually before adult females returned from their foraging bouts. On each visit all accessible banded bats were recaptured, and the measurements regarding their growth were taken again.

Results

Post-natal development

Neonates: The young are functionally altricial at birth, but they are extremely large, weighing 23.67% of the mother's postpartum mass. Several juveniles of *M. lyra* were collected with umbilical cords attached. Forearm length of individuals varied between 30.6 and 33.1 mm (x + SD = 31.63 ± 0.9 mm); the length of third finger varied between 41 and 43 mm (x + SD = 41.97 ± 0.7 mm) and fifth finger between 30.2 and 33.1 mm (x + SD = 31.67 ± 1.08 mm). These bats were considered neonates. Infants with long and fresh umbilical cords attached or infants with forearm length less than or equal to the length of the largest umbilical cord attached to the bat were considered to be one-day old (Kunz 1974). The umbilical cord in a newborn baby bat measured 31 mm. The umbilical cord remained

TABLE 1

MEASUREMENTS OF GROWTH PARAMETERS OF MALE AND FEMALE *M. LYRA NEONATES.*

Forearm length (mm)		III finger (mm)		V finger (mm)	
male	female	male	female	male	female
31.3 (±0.482)	31.3 (±0.573)	42.0 (±0.729)	41.7 (±0.608)	32.3 (±0.647)	32.0 (±0.906)

The numbers in parentheses denote standard deviation.

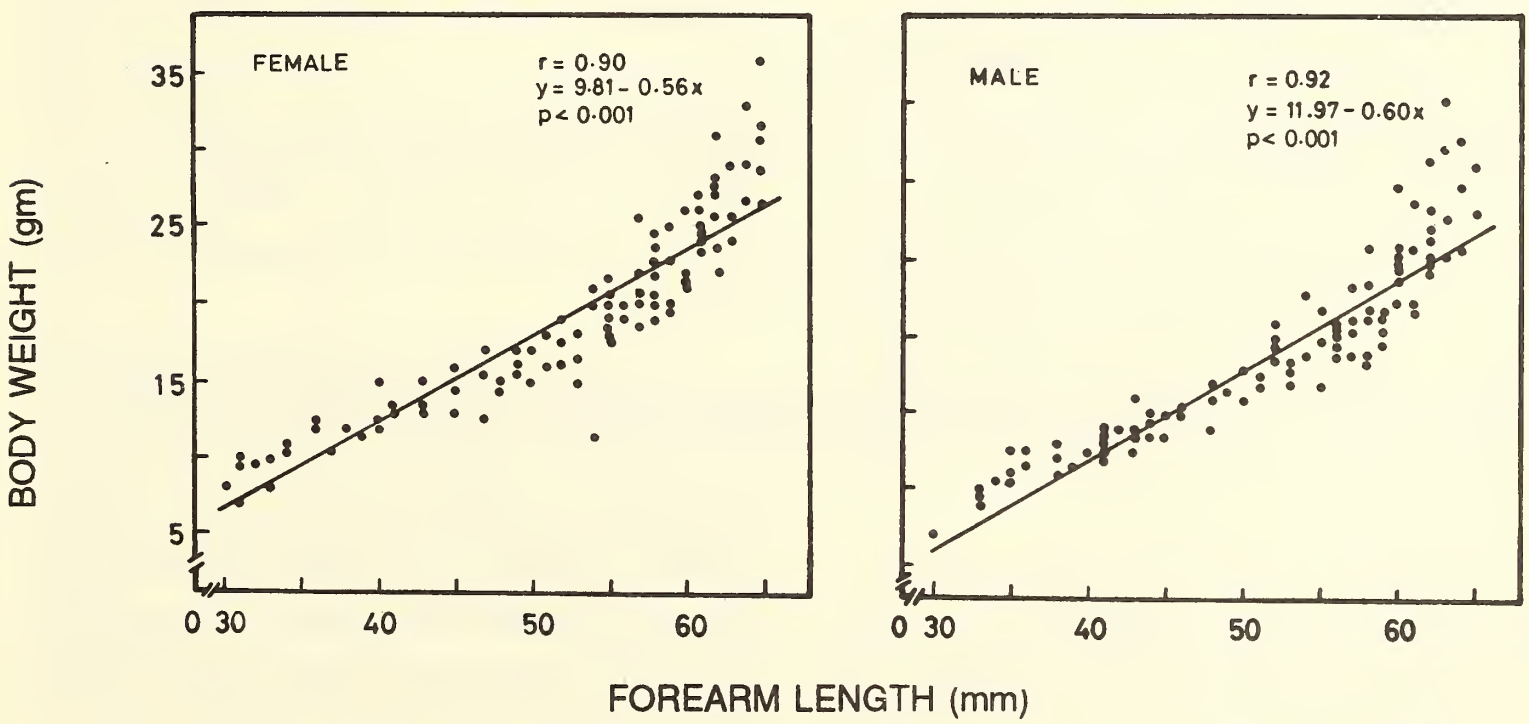

Fig.1. Regression of body weight and forearm length in males and females of *M. lyra*.

TABLE 2

GROWTH PATTERN OF A TAGGED MALE JUVENILE *M. LYRA*.

Date	Body weight (g)	Forearm length (mm)	III Finger (mm)	V Finger (mm)	Stage
15.3.90	8.6 (24.2)	30.6 (46.4)	42.3 (35.3)	31.6 (34.0)	Neonate
20.3.90	12.0 (33.7)	36.0 (54.5)	54.0 (45.0)	41.0 (44.1)	
13.4.90	20.0 (56.2)	55.0 (83.3)	92.0 (76.7)	72.0 (77.4)	
19.4.90	21.1 (59.3)	56.0 (84.8)	95.0 (79.0)	74.0 (79.6)	
21.4.90	21.6 (60.7)	56.0 (84.8)	96.0 (80.0)	75.0 (80.6)	Volant
26.4.90	22.8 (80.1)	60.0 (90.9)	101.0 (84.2)	79.0 (85.0)	
14.5.90	28.5 (80.1)	64.0 (97.0)	110.0 (91.7)	85.0 (91.4)	
27.5.90	30.5 (85.7)	65.0 (98.5)	119.0 (99.2)	89.0 (95.7)	Weaned
Mother bat					
21.4.90	35.6	66.0	120.0	93.0	

Percentage of mother's postpartum measurements are in parentheses.

attached to the baby till it reached a maximum weight of 13 g with maximum forearm length of 38 mm. The length of the third and fifth fingers was 59 mm and 47 mm respectively. The growth parameters measured in male and female bats did not differ significantly (Table 1).

Fledgling stage: Young *M. lyra* began to fledge when they reached 58.85% of the mother's postpartum body weight. The forearm length of the fledglings varied between 55 and 58 mm (x + SD = 56.9 $\pm$ 1.7 mm); the length of the third finger varied between 84 and 96 mm (x + SD = 91.5 $\pm$ 3.5 mm) and fifth finger between 64 and 76 mm (x + SD = 70.8 $\pm$ 3.1 mm). The baby at this stage was able to crawl on the wall, flutter its wings, show free head and ear movements and even attempt to fly a short distance inside the temple roost.

Weaning: Young *M. lyra* did not begin to forage till they reached 80.85% (29.2 - 31.6 g) of the mother's postpartum body weight. The mean body weight at weaning was 30.06 $\pm$ 0.9 g (n=10). The forearm length varied between 61 and 66 mm which is 97.55% of the adult size (x + SD = 63.9 $\pm$ 1.7 mm), the third finger length varied between 105 and 126 mm, which is 97.82% of the adult size (x + SD = 116.9 $\pm$ 6.3 mm) and the length of the fifth finger varied between 84 and 92 mm which is 92.43% of the adult size (x + SD = 88.0 $\pm$ 2.7 mm). The juvenile at this stage is able to fly well. The rate of growth of a tagged individual male *M. lyra* is represented in Table 2 which exhibits a pattern similar to that obtained from cumulative data on several bats.

The body weight and the length of the third and fifth fingers of the juvenile are significantly and positively correlated with forearm length from neonates to weaned young. The correlation coefficients are found to be significant (r-value ranging from 0.90 to 0.97) for both juvenile males and juvenile females (Fig. 1 and 2). Comparison of the body weights and finger measurements with the forearm measurements among juveniles

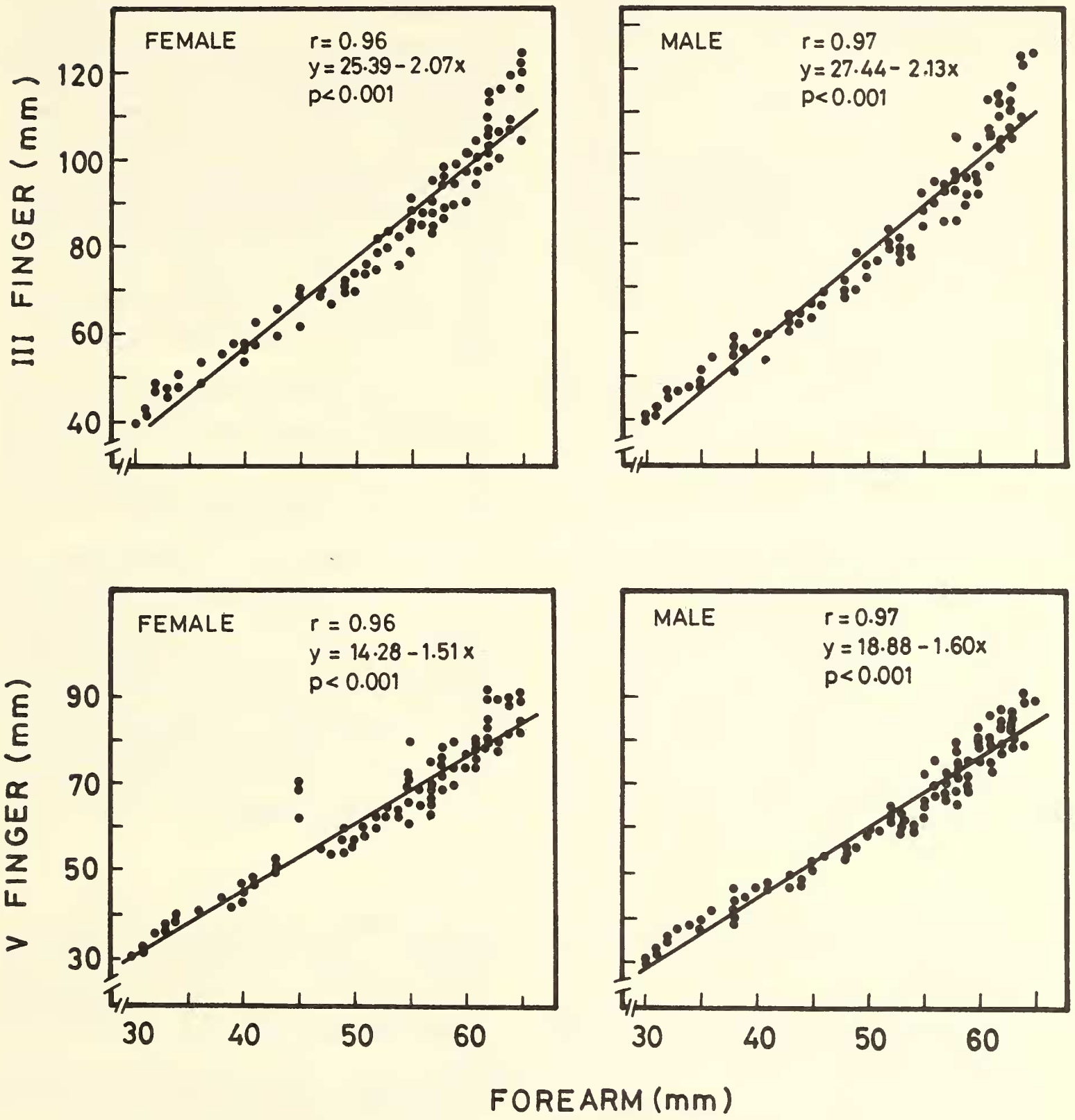

Fig.2. Regression of length of III finger, V finger and forearm length in males and females of *M. lyra*

indicates that the growth of forearm and fingers and gain in body weight is a continuous process from the neonatal period till the weaning is over.

Discussion

The post-natal development of young bats varies from species to species (Orr 1970). Newborn young of *M. lyra* were naked with their eyes closed. The eyes opened at about 5 days after birth and fur formation was not dense. According to the reports of several authors, the eyes opened at different age levels for different species, which varied from a few hours after birth to about 10 days of age (Jones 1967; Gould 1971; Kunz 1971). Interestingly, in the phyllostomid bat *Artibeus planirostris trinitatis* (Jones 1946), the eyes opened at birth and the head, back, forearms and interfemoral membranes were covered with hair. According to Orr (1970), members of the Megachiroptera were more advanced in development than the Microchiroptera at birth. This statement accords with the observation that the eyes of *Cynopterus sphinx* are open at birth. However, Kulzer (1958) reported that the eyes of *Rousettus aegyptiacus* do not of open until the young are 9 days old.

The length of the forearm has been the most consistently measured parameter of growth (Gould 1971; Kunz 1971) and in *M. lyra* the forearm length at the time of birth and at the time of weaning (about 2 1/2 months of age) was 48.3% and 97.5% of the adult measurement respectively. This is in accordance with the development of the forearm length in different species of vespertilionids, such as *Myotis velifer* (Kunz 1971). However, young bats of these species are weaned at the age of 6 weeks. The temporal variations could well be related to inter-specific differences in the maturity of the young at birth.

According to Orr (1970), the body weight of newborn bats ranges from 15 to 30% of the weight of non-pregnant adult females, which agrees with our observations and several other reports (Kleiman 1969; Kunz 1971).

Body weight in *M. lyra* was found to be reduced in most of the young bats following the critical period of weaning, since during this stage (between weaning and post-weaning) mothers paid relatively little attention to their young. In addition to the neglect in suckling and reduced lactation among mothers at this stage, young bats had to face difficulties in capturing enough prey due to poor foraging skills.

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